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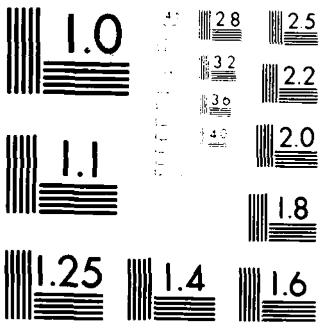

MICROCOPY RESOLUTION TEST CHART

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

We have investigated the cerebral effects of deep cerebral hypothermia (8°C) and rewarming on cerebrovascular, cerebral metabolic and brain electrical function. Results show that progrssively cooling the brain to 8°C produces a decrease in cerebral blood flow and a larger linear decrease in cerebral oxygen consomption and loss of electrical function. Results indicate that even with marked cerebral hypothermia, all physiological and electrical functions can be recovered with proper rewarming procedure.

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Final Report

Office of Naval Research Contract #N00014-80-C-0787

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The research supported by funds provided by the office of Naval Research investigated the effect of deep cerebral hypothermia on cerebral oxygen consumption ($CMRO_2$) and cerebral blood flow (CBF) and brain electrical activity. The purpose of these studies was to determine the extent to which an animal subjected to extreme conditions of cerebral hypothermia could be rewarmed and recover cerebral function. These studies were performed in goats. In order to investigate the direct effects of brain hypothermia in these animals without the complicating factors of simultaneous cardiovascular depression, the cerebral circulation was isolated surgically and cerebral perfusion pressure maintained constant by means of an in-series perfusion pump. Blood withdrawn from the goat's own arterial blood supply could then be selectively heated or cooled by a heat exchange system before being pumped in to the isolated cerebrovascular system. Using these methods we were able to selectively cool the goat brain to temperatures of 8°C with subsequently rewarming. The results, shown in fig 1, indicate that cerebral hypothermia produced with a constant cerebral perfusion pressure produces significant decreases in CBF which are not different at brain temperatures of 28°C, 18°C or 8°C. In contrast, $CMRO_2$ decreased progressively with decreasing brain temperature, following a linear pattern from 38°C to 8°C. Both CBF and $CMRO_2$ recovered to control levels following one hour of rewarming at 38°C. Somatosensory evoked cortical potentials, shown in fig 2, showed an increase in latency and a decrease in amplitude with decreasing brain temperature but recovered substantially with

rewarming. These results indicate that selective brain hypothermia will lead to marked deficits in all measures of cerebral function but these parameters can be recovered close to control levels by ideal rewarming conditions.

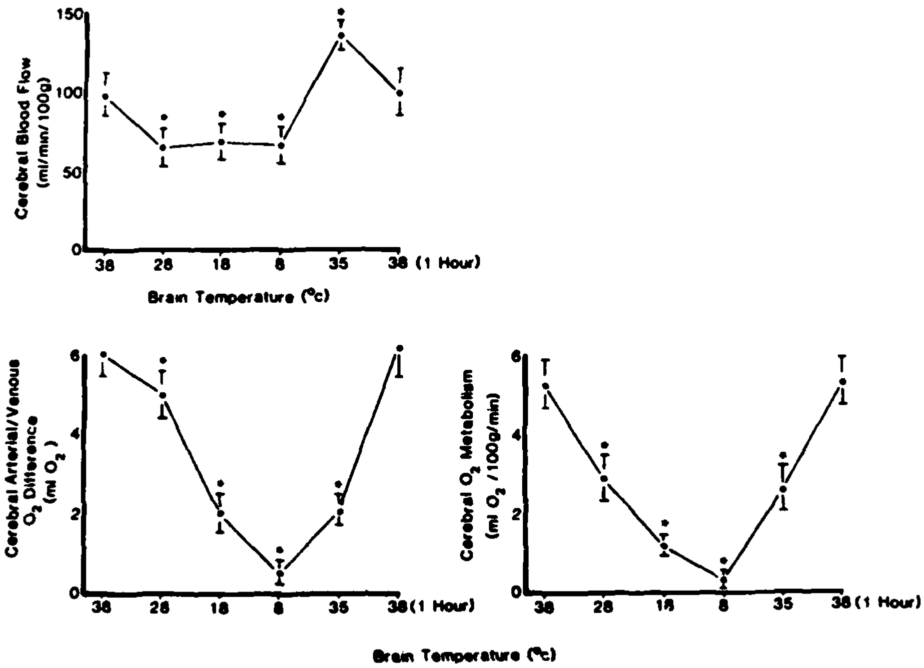

Fig. 1 CBF, a-vO_2, and $CMRO_2$ changes in eight goats during hypothermia and rewarming. Asterisks indicate difference from first (control) measure (P .05).

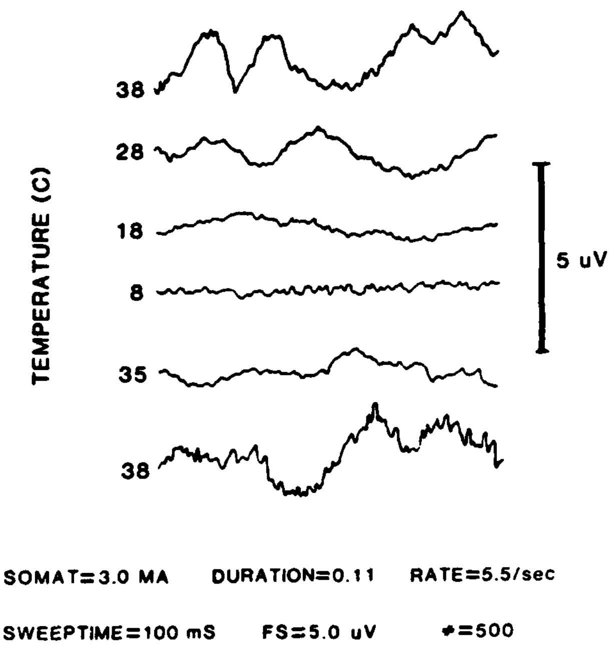

Fig. 2. Somatosensory evoked cortical potentials during hypothermia and rewarming. Supramaximal right median nerve stimulation was performed (3-mA current, 0.11-msec duration) at a rate of 5.5/sec. Sweeptime was 100 msec and the number of averaged potentials equals 500. Hypothermia produced a decrease in evoked cortical potentials and a shift to the right of each peak with recovery upon rewarming.

In other studies the regional CBF effects of selective cerebral hypothermia were investigated to determine whether the cerebrovascular effects of hypothermia were regionally selective. The data, shown in fig 3, indicate that cooling the brain to 8°C produced the greatest decrease in CBF in cortical brain tissues. Flow to these tissues recovered at least partially following rewarming. In contrast, subcortical structures including the thalamus, hypothalamus and brain stem showed little vasoconstriction during hypothermia. CBF also returned to at least control levels in these tissues following rewarming with the brain stem showing a prolonged hyper-perfusion

state. These results indicate that the cerebrovascular effects of brain hypothermia are selective in nature, with cortical tissues showing the greatest vasoconstriction and lower brain structure less effect. They also indicate that a return to normal CBF levels upon rewarming does not indicate complete recovery of cerebrovascular perfusion. After rewarming cortical CBF is still significantly decreased while brain stem blood flow is above control levels.

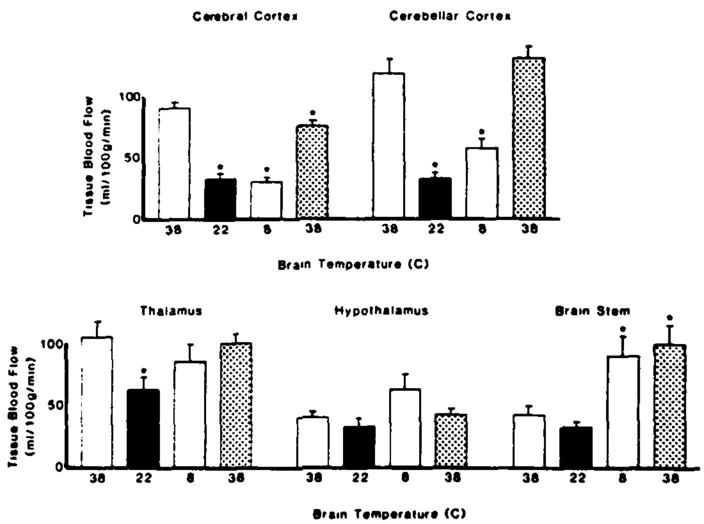

Fig. 3. Regional CBF changes during hypothermia and rewarming. Significant values indicate difference from control blood flow in each tissue which was obtained with first microsphere test. From 22 to 8°C, flow increased significantly in all tissues except cerebral cortex.

Overall, these data show that while brain metabolic and electrical function is abolished by cerebral hypothermia, the marked hypoperfusion of the brain which has been reported by others during whole body hypothermia appears more a function of the depressed cardiovascular system than cerebrovasoconstriction. In addition, our results suggest that fast rewarming of brain tissue maintained with adequate and perhaps supplementary cerebral perfusion pressure can lead to substantial recovery of cerebrovascular, cerebral metabolic and brain electrical activity.

REFERENCES

1. Hoffman WE, Miletich DJ, Albrecht RF: Differential Cerebral Hypothermia. Cryobiology 19: 392-401, 1982.
2. Hoffman WE, Albrecht RF, Mieltich DJ: Regional Cerebral Blood Flow Changes During Hypothermia. Crybobiology 19: 640-645, 1982).

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